

CLAIMS

1. A method for producing a color conversion table by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table.
2. An image processing device carrying out image processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table.
3. The image processing device according to claim 2, wherein said smoothing level evaluation function includes an evaluation function based on a twisted quantity of an ink-quantity vector before and after the conversion using the color conversion table.
4. The image processing device according to claim 2 or 3, wherein said smoothing level evaluation function includes an evaluation function based on a twisted quantity in a virtual CMY space.
5. The image processing device according to any one of claims 2 through 4, wherein said twisted quantities are corrected both in said ink-quantity space and said three-dimensionalized virtual CMY space so as to correct the twisted quantities while maintaining continuity of the space before and after compression of the dimension.
6. The image processing device according to any one of claims 2 through

5, wherein said smoothing level evaluation function includes an evaluation function based on a deviation level from a target ink quantity.

7. The image processing device according to any one of claims 2 through 6, wherein said smoothing level evaluation function includes an evaluation function based on a deviation level from target virtual CMY.

8. The image processing device according to any one of claims 2 through 7, wherein said smoothing level evaluation function includes an evaluation function based on an excess level from an ink quantity limitation.

9. The image processing device according to any one of claims 2 through 8, wherein said smoothing level evaluation function includes an evaluation function based on an ink quantity reduced to minus.

10. The image processing device according to any one of claims 2 through 9, wherein said smoothing level evaluation function includes an evaluation function based on ink generation.

11. An image processing method for carrying out image processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table.

12. A program of instructions for execution by the computer to perform an image-processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level at

respective lattice point data after color conversion by the color conversion table.

13. A method for producing a color conversion table by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table in a perceptually uniform color space such as the Lab space.

14. An image processing device carrying out image processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table in a perceptually uniform color space such as the Lab space.

15. The image processing device according to claim 14, wherein said smoothing level evaluation function includes an evaluation function based on a twisted quantity due to the perceptually uniform color space such as the Lab space before and after the color conversion using the color conversion table.

16. The image processing device according to claim 14 or 15, wherein said smoothing level evaluation function includes an evaluation function based on a deviation level from the target perceptually uniform color space such as the Lab space.

17. An image processing method carrying out image processing using a color conversion table produced by using a smoothing level evaluation

function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table in a perceptually uniform color space such as the Lab space.

18. A program of instructions for execution by the computer to perform an image-processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table in a perceptually uniform color space such as the Lab space.

19. A method for producing a color conversion table by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table in a color space such as the CMY space.

20. An image processing device carrying out image processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table in a color space such as the CMY space.

21. The image processing device according to claim 20, wherein said smoothing level evaluation function includes an evaluation function based on a twisted quantity due to the color space such as the CMY space before and after the color conversion using the color conversion table.

22. The image processing device according to claim 20 or 21, wherein

said smoothing level evaluation function includes an evaluation function based on a deviation level from target CMY values.

23. The image processing device according to any one of claims 20 through 22, wherein said smoothing level evaluation function includes an evaluation function preventing the CMY value from exceeding 255.

24. The image processing device according to any one of claims 20 through 23, wherein said smoothing level evaluation function includes an evaluation function preventing the CMY value from being reduced to minus.

25. An image processing method carrying out image processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table in a color space such as the CMY space.

26. A program of instructions for execution by the computer to perform an image-processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table in a color space such as the CMY space.

27. A method for producing a color conversion table by using a smoothing level evaluation function used for evaluating a smoothing level of color data at respective lattice points after color conversion by the color conversion table, and simultaneously, carrying out the color conversion such that the

chroma represented by the color data at the respective lattice points is maintained approximately constant before and after said smoothing.

28. An image processing device carrying out image processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level of color data at respective lattice points after color conversion by the color conversion table, and simultaneously, carrying out the color conversion such that the chroma represented by the color data at the respective lattice points is maintained approximately constant before and after said smoothing.

29. The image processing device according to claim 28, wherein said color conversion table carries out the color conversion such that, as for such color data at the lattice point that the chroma represented by the color data decreases after said smoothing compared with the chroma represented by the color data before said smoothing, the chroma represented by the color data is maintained approximately constant before and after said smoothing.

30. The image processing device according to claim 29, wherein said color conversion table carries out the color conversion such that, as for such color data at the lattice point that a ratio of the chroma represented by the color data after said smoothing to the maximum chroma determined by the hue and lightness represented by the color data after said smoothing decreases compared with a ratio of the chroma represented by the color data before said smoothing to the maximum chroma determined by the hue and lightness represented by the color data after said smoothing, the chroma represented by the color data is maintained approximately constant before

and after said smoothing.

31. The image processing device according to claim 28 or 29, wherein said color conversion table carries out the color conversion such that, as for such color data as presenting the maximum chroma, the chroma represented by the color data is maintained approximately constant before and after said smoothing.

32. The image processing device according to claim 28 or 29, wherein said color conversion table carries out the color conversion such that, as for such color data as not including at least one color of a plurality of element colors constituting the color data as a component color, the chroma represented by the color data is maintained approximately constant before and after said smoothing.

33. The image processing device according to any one of claims 28 through 32, wherein said color conversion table carries out the color conversion such that a ratio of the chroma represented by the color data at the lattice point after said smoothing to the maximum chroma determined by the hue and lightness represented by the color data after said smoothing, and a ratio of the chroma represented by the color data before said smoothing to the maximum chroma determined by the hue and lightness represented by the color data after said smoothing are maintained approximately constant.

34. The image processing device according to any one of claims 28 through 33, wherein said smoothing level evaluation function includes an

evaluation function based on a twisted quantity of an ink-quantity vector before and after the conversion using the color conversion table.

35. The image processing device according to any one of claims 28 through 34, wherein said smoothing level evaluation function includes an evaluation function based on a twisted quantity in a virtual CMY space.

36. The image processing device according to any one of claims 28 through 35, wherein said twisted quantities are corrected both in said ink-quantity space and said three-dimensionalized virtual CMY space so as to correct the twisted quantities while maintaining continuity of the space before and after compression of the dimension.

37. The image processing device according to any one of claims 28 through 36, wherein said smoothing level evaluation function includes an evaluation function based on a deviation level from a target ink quantity.

38. The image processing device according to any one of claims 28 through 37, wherein said smoothing level evaluation function includes an evaluation function based on a deviation level from target virtual CMY.

39. The image processing device according to claim 38, wherein said color conversion table carries out the color conversion such that the chroma represented by the color data is maintained approximately constant before and after said smoothing in said target virtual CMY.

40. The image processing device according to any one of claims 28

through 39, wherein said smoothing level evaluation function includes an evaluation function based on an excess level from an ink quantity limitation.

41. The image processing device according to any one of claims 28 through 40, wherein said smoothing level evaluation function includes an evaluation function based on an ink quantity reduced to minus.

42. The image processing device according to any one of claims 28 through 41, wherein said smoothing level evaluation function includes an evaluation function based on ink generation.

43. An image processing method carrying out image processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level of color data at respective lattice points after color conversion by the color conversion table, and simultaneously, carrying out the color conversion such that the chroma represented by the color data at the respective lattice points is maintained approximately constant before and after said smoothing.

44. A program of instructions for execution by the computer to perform an image-processing using a color conversion table produced by using a smoothing level evaluation function used for evaluating a smoothing level of color data at respective lattice points after color conversion by the color conversion table, and simultaneously, carrying out the color conversion such that the chroma represented by the color data at the respective lattice points is maintained approximately constant before and after said smoothing.

45. A profile producing device producing a profile by using a color chart output by an image output device comprising:

a smoothed table producing means for producing a color conversion table smoothed by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table;

a color chart producing means for causing the image output device to output the color chart based on desired image input data using the smoothed color conversion table produced by said smoothed table producing means;

a colorimetry means for obtaining a colorimetry value of the color chart; and

a profile producing means for producing a profile from a correspondence between said desired image input data and the colorimetry value corresponding to said image input data.

46. The profile producing device according to claim 45, wherein said desired image input data include a device value depending on a color reproduction characteristic of the image output device.

47. The profile producing device according to claim 46, wherein the device value depending on the color reproduction characteristic of said image output device includes RGB values, CMY values, or CMYK values.

48. The profile producing device according to any one of claims 45 through 47, wherein said colorimetry value is a colorimetry value indicating appearance of a color.

49. The profile producing device according to claim 48, wherein said colorimetry value indicating the appearance of the color includes Lab values, Luv values, XYZ values, or CIE CAM 97S.

50. The image processing device according to any one of claims 45 through 49, wherein said smoothing level evaluation function includes an evaluation function based on a twisted quantity of an ink-quantity vector before and after the conversion using the color conversion table.

51. The image processing device according to any one of claims 45 through 50, wherein said smoothing level evaluation function includes an evaluation function based on a twisted quantity in a virtual CMY space.

52. The image processing device according to any one of claims 45 through 51, wherein said twisted quantities are corrected both in said ink-quantity space and said three-dimensionalized virtual CMY space so as to correct the twisted quantities while maintaining continuity of the space before and after compression of the dimension.

53. The image processing device according to any one of claims 45 through 52, wherein said smoothing level evaluation function includes an evaluation function based on a deviation level from a target ink quantity.

54. The image processing device according to any one of claims 45 through 53, wherein said smoothing level evaluation function includes an evaluation function based on a deviation level from target virtual CMY.

55. The image processing device according to any one of claims 45 through 54, wherein said smoothing level evaluation function includes an evaluation function based on an excess level from an ink quantity limitation.

56. The image processing device according to any one of claims 45 through 55, wherein said smoothing level evaluation function includes an evaluation function based on an ink quantity reduced to minus.

57. The image processing device according to any one of claims 45 through 56, wherein said smoothing level evaluation function includes an evaluation function based on ink generation.

58. A profile producing method producing a profile by using a color chart output by an image output device comprising:

- a smoothed table producing step for producing a color conversion table smoothed by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table;

- a color chart producing step for causing the image output device to output the color chart based on desired image input data using the smoothed color conversion table produced by said smoothed table producing step;

- a colorimetry step for obtaining a colorimetry value of the color chart;
- and

- a profile producing step for producing a profile from a correspondence between said desired image input data and the colorimetry value corresponding to said image input data.

59. A program of instructions for execution by the computer to perform a profile producing method producing a profile by using a color chart output by an image output device, said profile producing method comprising:

a smoothed table producing step for producing a color conversion table smoothed by using a smoothing level evaluation function used for evaluating a smoothing level at respective lattice point data after color conversion by the color conversion table;

a color chart producing step for causing the image output device to output the color chart based on desired image input data using the smoothed color conversion table produced by said smoothed table producing step;

a colorimetry step for obtaining a colorimetry value of the color chart;
and

a profile producing step for producing a profile from a correspondence between said desired image input data and the colorimetry value corresponding to said image input data.

60. A recording medium readable by a computer recording a program according to any one of claims 56, 18, 26, and 44.

61. A method for producing a color conversion table using a plurality of costs used for evaluating a level of smoothing at respective lattice point data after color conversion using the color conversion table.